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EXAMINER

VINH, LAN

ART UNIT

PAPER NUMBER

1765

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17

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/662,682

Applicant(s)

LI ET AL.

Examiner

Lan Vinh

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 May 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 15 6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-2, 4-5, 10, 11-12, 14-15 are rejected under 35 U.S.C. 102(b) as being anticipated by Lee et al (US 5,565,084)

Lee discloses an electropolishing method for etching substrate. This method comprising/consisting of the steps of:

coating a metal/gold layer on the silicon substrate, the metal layer having a thickness of 1000 angstroms (100 nm) (col 3, lines 64-65, col 4, lines 32-33, fig. 1F shows a thin discontinuous metal layer 15 formed on the Si substrate 11), which reads on depositing a thin discontinuous layer of metal on a Si surface

immersing the gold/metal coated Si substrate in a HF and nitric acid solution, the HF in the etchant solution make the Si substrate porous, etching the Si substrate by breaking the supply of the electricity for 1 minutes (col 4, lines 31-43), which reads on forming the porous silicon by etching the Si surface having the discontinuous layer in a HF and oxidant solution for a period of about two second up to 60 minutes, the etching being conducted without external electrical bias

Regarding claims 2, 12, Lee is silent about the use of illumination during the etching step which reads on the step of etching is conducted in the absence of illumination.

Art Unit: 1765

Regarding claims 4, 14, Lee discloses using Pt as the metal layer (col 3, lines 64-65)

The limitations of claims 5, 10, 15 have been discussed above.

3. Claim 21 is rejected under 35 U.S.C. 102(b) as being anticipated by Lee et al (US 5,565,084)

Lee discloses an electropolishing method for etching substrate. This method comprising/consisting of the steps of:

coating a metal/gold layer on the silicon substrate, the metal layer having a thickness of 1000 angstroms (100 nm)/nanosize (col 3, lines 64-65, col 4, lines 32-33, fig. 1F shows a thin discontinuous metal layer 15 formed on the Si substrate 11). Since Lee discloses forming the discontinuous metal layer of the same material (gold) and having a thickness of the same dimension (nanosize) as the claimed metal layer, it is inherent that Lee's metal layer having a thickness sufficient to permit nucleation that form nanometer size metal particles and small enough to prevent formation of a continuous metal layer

immersing the gold/metal coated Si substrate in a HF and nitric acid solution, the HF in the etchant solution make the Si substrate porous, etching the Si substrate by breaking the supply of the electricity for 1 minutes (col 4, lines 31-43), which reads on forming the porous silicon by etching the Si surface having the discontinuous layer in a HF and oxidant solution for a period of about two second up to 60 minutes, the etching being conducted without external electrical bias

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 3, 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al (US 5,565,084) in view of Russell et al (US 6,093,941)

Lee's method has been described above in paragraph 2. Lee differs from the instant claimed inventions as per claims 3, 13 by conducting the etching without the illumination instead of conducting the etching in the presence of illumination.

However, Russell, in a method of forming porous region in a light emitting silicon structure, teaches that luminescent porous silicon can be produced using either chemical stain etch (without illumination) or photochemical etch (with illumination) (col 6, lines 65-67; col 7, lines 10-12)

Hence, one skilled in the art would have found it obvious to modify Lee etching step to form porous silicon by conducting the etching in the presence of illumination in view of Russell teaching because Russell discloses that as the illumination time during etching increases, the etching spreads out to regions of the silicon which were not illuminated and small etched features becomes washed out consistent with the generation of holes/pores required for the catalysis of the etching mechanism (col 6, lines 9-13)

Art Unit: 1765

6. Claims 6, 7, 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al (US 5,565,084) in view of Yoshikawa et al (US 5,990,605)

Lee's method has been described above in paragraph 2. Lee differs from the instant claimed invention as per claims 6, 16 by depositing a metal layer of gold (Au) instead of Pd (Palladium)

However, Yoshikawa, in a method of forming an electron emission device include a porous semiconductor, discloses that Au or Pd can be used as metal coating on a porous silicon surface 13 (col 7, lines 31-35)

Hence one skilled in the art would have found it obvious to substitute Lee metal layer of Au with Pd in view of Yoshikawa teaching because both Au and Pd are known metals for using as a metal coating on a porous surface, thus the substitution of one for the other would have produced an expected result.

Unlike the instant claimed invention as per claims 7, 17, 18, Lee does not specifically discloses forming a combination of metals selected from the group consisting of :Au, Pt and Pd.

Yoshikawa also discloses that metals of Au, Pt and Pd can be used as an alloy metal coating on a porous silicon surface 13 (col 7, lines 31-37) which reads on using a combination of metals selected from the group consisting of :Au, Pt and Pd.

Hence one skilled in the art would have found it obvious to modify Lee metal layer by forming an alloy metal layer as per Yoshikawa because Yoshikawa states that an alloy/combination of metal contain Au and Pt is desirable to make the thin film metal very thin to increase electron emission (col 7, lines 45-49)

Art Unit: 1765

7. Claims 8, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al (US 5,565,084) in view of Hwang et al (US 4,681,657)

Lee method has been described above in paragraph 2. Lee differs from the instant claimed inventions as per claim 8, 19 by etching using HF and an oxidant of HNO_3 instead of HF and an oxidant H_2O_2 .

However, Hwang discloses that HNO_3 and H_2O_2 can be used as oxidizer/oxidant in a HF solution that is used to wet etch silicon wafer (col 1, lines 8-14)

Hence, one skilled in the art would have found it obvious to substitute Lee etching solution of HF and HNO_3 with an etching solution of HF and H_2O_2 in view of Hwang teaching because both etching solutions have the same function of wet etching silicon ; therefore, the substitution of one for the other would have produced an expected result.

8. Claims 9, 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al (5,565,084) in view of Yoshikawa et al (US 5,990,605)

Lee's method has been described above in paragraph 2. Although Lee discloses forming a thin metal coating of Au/Pt on the silicon surface, Lee does not specifically disclose that the thickness of the metal is less than approximately 10 nm.

However, Yoshikawa discloses a method of forming an electron emission device include a porous semiconductor comprises the step of forming a thin (thickness of 2 nm)/less than approximately 10 nm metal layer 15 on a porous silicon surface 13 (col 7, lines 51-54)

Art Unit: 1765

Since Lee discloses forming a thin metal coating of Au/Pt, one skilled in the art would have found it obvious to modify Lee metal forming step by forming a thin metal layer having the thickness as taught by Yoshikawa because according to Yoshikawa when considering the stability as an electron/light emission device a thin (2nm) is the most suitable for the Au or Pt thin film/coating on a porous surface (col 7, lines 53-55)

Response to Arguments

9. Applicant's arguments with respect to claims 1-21 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 703 305-6302.

The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on 703 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872-9310 for regular communications and 703 872-9311 for After Final communications.



LV

July 3, 2003